Steam Boilers

Optional Equipment

Condensate Return Systems

Chromalox condensate return systems are used wherever condensed steam can be collected for reuse in the boiler. Significant energy can be saved by returning hot condensate to the boiler for feed water. The condensed water is free from corroding minerals and contains a substantial amount of heat energy which does not have to be replenished.

CAUTION — When a condensate system is used, a vacuum breaker must always be installed on the boiler to prevent the boiler from flooding during shut down.

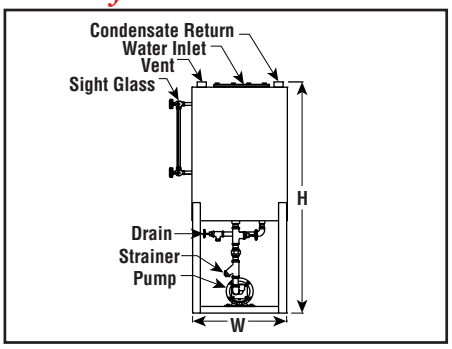
Low and Medium Pressure Condensate Return Systems (150 psig maximum). Chromalox condensate return systems (except model HPCS 3003) are designed for use with steam boilers operating up to 150 psig steam pressures. The condensate systems consist of an 11 gauge steel tank, motor, pump, float valve, sight glass and associated plumbing. A 1/2" inlet is located on the tank for connection to a local water supply for make up water. A "vent" is located on the top of the tank and is open to the atmosphere. The "return" connection is plumbed to the trapped condensate return line from the process.

The condensate tank has an internal ball check valve, a float and float arm which mechanically opens a valve, allowing make up water to enter the tank as the original supply is depleted. The outlet of the pump is plumbed to the boiler water inlet check valve. The pump motor is wired to the boiler feed water control or motor starter. No further adjustments and/or plumbing are required other than plumbing the condensate tank drain and drain valve to a proper waste connection.

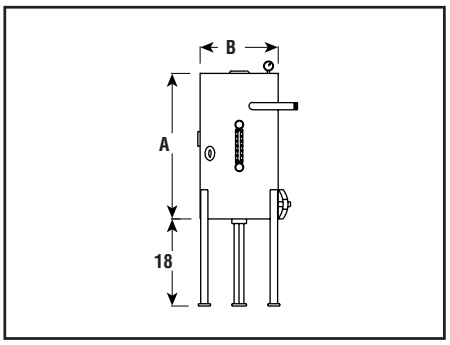
High Pressure Condensate Return Systems (250 psig maximum). The Chromalox HPCS3003 high pressure (250 psig maximum) condensate return system is specifically designed for use with the CHPES-6 through 180 kW boilers whenever condensate is to be returned for reuse.

The high pressure condensate return system consists of a 30 gallon tank with an internal make up water float valve, a 3 Hp three phase motor (motor voltage will match the boiler's voltage), a special high-pressure pump and a sight glass. A motor starter and fuses can be supplied as an option. Installation requires wiring and field plumbing to the boiler with minimum 1/2" NPT piping rated at 250 psig.

ES38038V Condensate Return System



CSB-1 Blow Down Separator — Dimensions (Inches)



Condensate Return System Selection

For Use On	Storage Tank Max. Gal.	Storage Tank Max. psig	Motor Volts	Motor Ph	Motor Hp	Dimensions (In.) L	Dimensions (In.) W	Dimensions (In.) H	Model	Stock	PCN	Wt. (Lbs.)
CES 6 -100	26	110	115/230	1	1/3	14-1/2	14-1/2	48	**ES38083V**	**NS**	**109372**	125
CES 135 -180	33	130	115/230	1	1/2	14-1/2	14-1/2	54	**ES38084V**	**NS**	**109399**	240
CHS 150 - 300	33	150	115/230	1	3/4	14-1/2	14-1/2	54	HS38019V	NS	—	260
CHS 360 - 810	46	150	230/460	3	3	14-1/2	14-1/2	66	HS38031V	NS	—	310
CHS 945 -1215	50	150	230/460	3	5	20	50	40	HS38039H	NS	—	365
CHS 1320 -1620	Contact Factory for Recommendations											
CHPES 6 -180	30	235	230/460	3	3	34-1/4	41-1/2	21	HPCS3003H	NS	109428	310
CSSB 6 -180	Stainless steel boilers require de-ionized water. Contact your Local Chromalox Sales office.											

Stock Status: **S** = stock AS = assembly stock NS = non-stock
To Order— Specify model number of condensate system, boiler model number, volts, phase, kW, PCN if applicable, and quantity.
Note —
A. Connections (NPT): Pump Out = 1", Tank Return = 1-1/4"
B. All motors can operate on 208V. Systems for boilers larger than 810 kW have horizontal tanks. Use ES38084V for all CES boilers with 135 psig trim.

Blow Down Separators

Many state and municipal boiler codes do not permit discharge of boiler blow down directly into city sewers. Chromalox blow down separators separate liquid from vapor during blow down and prevent the dangerous discharge of live steam down city drains. The separator accepts water and flash steam from the boiler blow down, reducing temperatures and pressures to safe levels for subsequent discharge to the sewer.

The separator is kept half full of cold water before each blow down. The design utilizes a water seal at the outlet which permits the system to introduce cold water from the bottom to mix with the hot water and boiler steam blow down inside the separator. Flash steam is absorbed by the cold water and allowed to pass to the outside through a vent. Chromalox blow down separators, CSB-1, 2, 3 and 4 are built and stamped to Section VIII of the ASME Code.

Blow down separators require only plumbing from the boiler blow down, hook-up to a cold water supply line and connection to a drain. No electrical connections are required. Order options include a 0 - 30 psig pressure gauge, 0 - 200°F temperature gauge and a water sight glass gauge assembly.

Blow Down Separator Selection

Boiler	Boiler kW	DIM. A	DIM. B	NPT Inlet	NPT Outlet	PCN	Wt. (Lbs.)
CSB-1	6 - 200	24	16	1	1-1/2	109250	230
CSB-2	201 - 500	36	24	1	2-1/2	—	260
CSB-3	501 - 1000	48	36	1-1/4	3	—	290
CSB-4	1001 - 1620	72	42	1-1/2	3-1/2	—	320

Vacuum Breaker Systems

After boiler shut down, the steam inside the vessel condenses as the shell cools. This creates a vacuum which will siphon water into the boiler from the water feed or condensate return system, flooding the boiler. A vacuum breaker permits outside air to enter into the shell to relieve the vacuum, thus preventing excess water from being drawn into the vessel. The vacuum breaker consists of a valve with a spring loaded disc and associated piping, factory plumbed to the boiler. They can be used on all Chromalox boilers.

Vacuum Breaker Selection

Model	Use With Boiler	Max. Pressure (psig)	PCN
ES89369	CES	150	109479
ES89369SS	CSSB	150	—
HPES 89369	CHPES	300	109760

Steam Boilers

Optional Equipment *(cont'd.)*

Cold Water Feed Systems

Automatic water feed is required on all CES, CHPES, CHS and CSSB steam boilers. Water feed systems are available for low pressure and high pressure applications. Low pressure or solenoid feed systems may be used when the incoming water line pressure is at least 10 psig greater than the boiler operating pressure. High pressure or pump and motor feed must be used when the boiler operating pressure is greater than 10 psig less than incoming water line pressure.

A selection of different models is available depending on the size and pressure rating of the boiler. The correct water feed system may be determined from the following chart:

Water Feed System Selection

Boiler	Pressure	
	Low	High
CES 6-72 CES 100-180	ES99117 ES99117	ES38002/ES38020 ES38020/ES99157
CSSB 6-72 CSSB 100-180	ES99117SS ES99117SS	ES38002SS ES38020SS
CHPES 6-180 CHS 150	— HS99117	ES38020HP ES38020/ES99157
CHS 180-300 CHS 360-1620	HS99117 Note 1	ES38021 Note 1

Low-Pressure Water Feed Systems

Low pressure cold water feed systems supply makeup water to the boiler where incoming water line pressure is 10 psig or greater than the operating pressure of the boiler.

ES99117 — Low-Pressure Water Feed System 0 to 90 psig. ES99117 piping is 1/2" NPT and is completely factory plumbed and wired. The systems consists of strainer, solenoid valve and check valve. The solenoid valve is 120V/1/50 - 60 Hz. For CSSB boilers specify ES99117-SS with all stainless steel construction.

HS99117 — Low-Pressure Water Feed System for larger boilers 0 to 150 psig. The HS99117 is similar to ES99117 except piping is 1" NPT and a bypass system with a manual valve is provided for initial fill of larger boilers.

Notes —

1. For larger systems, use a condensate return system.
2. System equipped with two motorized ball valves for pressures above 100 psig.
3. High pressure feed systems ES38002 (SS), ES38020 (SS) and ES99157 can be mounted on CES & CSSB boiler enclosures.

HS99117 — Low Pressure Water Feed

ES38002 — High Pressure Water Feed

81025 — Blow Down Kit for CHPES

High-Pressure Water Feed Systems

High pressure cold water feed systems are used to maintain constant water level in the boiler when boiler operating pressure is equal to or greater than the incoming water line pressure.

ES38002 — System 0 - 90 psig — This water feed system is a separate pump and motor assembly requiring field plumbing and wiring to the boiler.[3] The piping is **1/2" NPT** and the assembly includes a **1/4 Hp** 120V/1/60 motor and pump piping, a strainer and a solenoid valve. The assembly is mounted on rubber shocks, secured on a steel base mounting plate. A flexible 18" high pressure hose with fittings is included for connection to boiler and a cable for electrical connection. For CSSB boilers 6 to 72 kW (stainless steel) and de-ionized water, specify **ES38002-SS[3].**

ES38020 — System 0 - 135 psig — This system is similar to ES38002 except it has **1/2" NPT** piping and a **1/3 Hp** 120V/1/60 motor and pump.[3] For CSSB boilers 72 to 180 kW (stainless steel) and de-ionized water, specify **ES38020-SS[3].**

ES99157 — System 0 - 135 psig — This system is similar to ES38002 except it has **1/2" NPT** piping and a more powerful **1/2 Hp** 120V/1/60 motor and pump.[3] Recommended for all CES boilers rated for 135 psig and heavy duty pumping applications.

HS38021 — System 0 - 135 psig — This system is similar to ES38002 except it has **1" NPT** piping and a **3/4 Hp** 120V/1/60 motor for greater capacity.

ES38020HP System 0 - 235 psig — This high pressure cold water feed system can be used with all CHPES boilers where the condensate is not returned. Installation requires plumbing and wiring between the pump assembly and the boiler. The system consists of a **3/4 Hp** 208/230/460V, 3ø motor, a positive displacement type pump, **1/2" NPT** piping, strainer and solenoid valve.

Automatic Blow Down Systems

Chromalox engineering recommends a factory-installed automatic blow down unit. Automatic blow down systems can:

- Save Labor Costs
- Extend Life of Boiler
- Automatically Start the Boiler in the Morning
- Automatically Shut the Boiler Down at Night
- Automatically Blow it Down Each Working Day
- Be Programmed to Skip Days and Week-ends.

The heart of the Chromalox automatic blow down unit is a motor-driven, straight-through, self-cleaning ball valve with Teflon® seats and stainless steel trim. It handles dirty fluids and particles without a strainer or other cleaning device. The ball valve and boiler are controlled by an electronic unit with a time clock and pilot lights which indicate when the drain valve is open or closed and when the boiler is on or off. Blow down can also be done manually, at any time, by means of a push button switch which momentarily de-energizes the boiler and opens the drain valve. The blow down system may be installed on any steam boiler regardless of size or operating duty cycle. Select from the following chart:

Automatic Blow Down System Selection

Model	Use With Boiler	Pipe NPT	Press. psig	Wt. (Lbs.)
81015A	CES 6-18, CHS-150	1/2	150	46
81015B 81015B	CES 24-180 CHS 150-420	1 1	150 150	46 46
81015SS	All CSSB	1	150	46
81115	CHS 495-630	1-1/2	150	46
81215	CHS 720-1,620	2	150	50
81025[2]	All CHPES	1	250	50

Steam Boilers

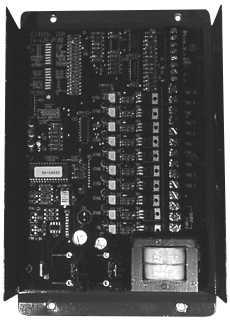
Optional Equipment *(cont'd.)*

Electric Element Sequencers

Sequencers are designed to apply power to large kW boilers in progressive stages. Automatic sequencing provides accurate and cost effective control, saving energy and minimizing wear and tear on electrical components. Sequencing extends the life of the individual heating elements by rotating the load evenly across all element bundles. Reacting to an input signal from a factory installed proportional pressure control, the sequencer energizes and de-energizes each heating element circuit through individual power contactors. The sequencer programs a delay before start up and between each subsequent step to eliminate power surges. Once up to power and pressure, the load is "fine-tuned" for close pressure control, with a minimum of over-shoot or droop. Each sequencer is pre-set to match the specific boiler and system requirements. In case of power interruption, the sequencer restarts with all steps de-energized. Electronic solid state sequencers are available with up to 20 steps or stages for efficient operation of any size Chromalox boiler.

Electronic Sequencer Operation — Solid state progressive sequencers provide accurate electronic control of multistage loads of the type used in Chromalox steam boilers. They feature progressive circular sequencing (first-on, first-off) which equalizes the operating time of each load and contactor. The control gives visual indication of each energized stage by means of integral solid state light emitting diodes. In the event of power interruption, all heating elements are immediately de-energized for safety. When power resumes, the control will restage the loads one at a time.

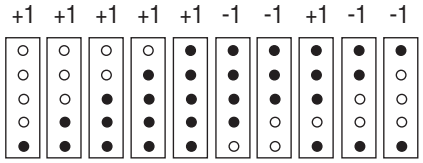
Electronic Solid State Sequencer (Control Board)



Circular sequencer operation and staging can be visualized by the referring to following illustration. The "O" represents an element bundle in the de-energized position. The "●" represents an element bundle which has been energized by the sequencer.

Visualization of Progressive Circular Sequencing

Progression —> —> —>

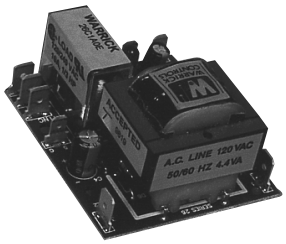


O = Stage "OFF" ● *= Stage "ON"*

Electronic Auxiliary Low Water Cutoff

An auxiliary low water cutoff can be used as a safe and reliable backup to the primary low water cutoff control and is required by some state and local boiler codes. Auxiliary low water cutoff is provided by an electronic device with a solid state amplifier and a solid state switch for operating the mechanical control relay. Operation is accomplished by sensing a minute current flow between submerged contact probe and the boiler shell. When water level falls below safe operating level, the boiler is shut down. Auxiliary low water cutoffs are standard on all CHS type steam boilers.

Electronic Level Control



Note — For single probe auxiliary low water cutoff (shown with plug-in control relay).

Note — Electronic auxiliary low water cutoffs are not appropriate for use with CSSB or other boilers using demineralized, de-ionized or distilled water. Contact your Local Chromalox Sales office for information on available stainless steel low water float switches for use with electronic auxiliary low water cutoffs.

Transformers

Transformers for control circuits and pump motors can be supplied to eliminate the need for separate 120 Vac power for control circuits. Transformer primary voltage will match boiler power voltage. Transformer secondary voltage will be 120 Vac unless otherwise specified.

Transformer Selection — To select transformer size, simply find the sum of all component kVA requirements to be powered by the transformer. A CES-72A with ES38083V condensate return system and 81015B automatic blow down system would require:

Basic Boiler	1/4 kVA
ES38083V	3/4 kVA
81015B	1/2 kVA
Total Required	1-1/2 kVA

Factory Mounted & Wired Transformer

Transformer Sizing — Basic Boiler

Basic Boiler	Min. kVA Required
CMB 6, 15 CES, CHPES, CSSB 6-72	1/4 1/4
CES 100-180, CHPES 100 CHS 150-420	1/2 1/2
CHS 495-630 CHS 720-1620	3/4 1

Minimum size transformer offered is 1.0 kVA.

Transformer Sizing-Option Loading

Option	Additional kVA Required
Water Feed Systems	
ES99117 (SS), HS991117	1/4
ES38002 (SS), ES38020 (SS)	3/4
ES99157	1
HS38021, ES38020HP	1-1/2
Automatic Blow Down Systems	
81015A, B, SS	1/2
81115, 81215	1/2
81025	1
Condensate Return Systems	
ES38083V	3/4
ES38084V	1
All 3-phase Condensate Return Systems (3 pole motor starter required)	1/4

BOILERS